

What is claimed is:

- 1 1. A method for restoring communications in a network,
2 the network having a plurality of nodes, with each pair
3 of nodes connected by a link, with each link having
4 information channels and restoration channels,
5 comprising the steps of:
6 sending an idle signal on each restoration channel
7 for each link;
8 detecting a failure of a link connecting an
9 originating node with a terminating node, said link
10 having at least one information channel carrying
11 information signals;
12 determining an alternate path through the network
13 for said information signals using restoration and idle
14 signals sent over said restoration channels; and
15 routing said information signals from said
16 originating node to said terminating node in accordance
17 with said alternate path.

1 2. The method of claim 1, wherein said step for
2 determining said alternate path comprises the steps of:
3 sending a restoration signal having a node
4 identification number for said originating node in a
5 restoration channel for each link connected to said
6 originating node;
7 sending a restoration signal having a node
8 identification number for said terminating node in a
9 restoration channel for each link connected to said
10 terminating node; and
11 routing said restoration signals through alternate
12 links and at least one intermediate node until said
13 restoration signal having a node identification number
14 for said originating node reaches said terminating node,
15 and said restoration signal having a node identification
16 number for said terminating node reaches said
17 originating node.

1 3. The method of claim 2, wherein said step of routing
2 said restoration signals through said intermediate node
3 comprises the steps of:
4 a) receiving a first restoration signal over a
5 first restoration channel for a first link at said
6 intermediate node;
7 b) sending said first restoration signal over a
8 restoration channel for each link connected to said
9 intermediate node except for said first restoration
10 channel;
11 c) receiving a second restoration signal over a
12 second restoration channel for a second link at said
13 intermediate node;
14 d) determining whether said node identification
15 number for said first restoration signal matches a said
16 node identification number for said second restoration
17 signal;
18 e) sending an idle signal over said second
19 restoration channel if said NIDs match;
20 f) sending said second restoration signal over
21 said first restoration channel if said NIDs do not
22 match; and
23 g) performing steps a) to f) for each
24 intermediate node receiving a restoration signal.

1 4. The method of claim 3, further comprising the steps
2 of:
3 a) receiving a first idle signal over a
4 restoration channel for a link connected to said
5 intermediate node;
6 b) sending a second idle signal over said
7 restoration channel over which said first idle signal
8 was received; and
9 c) performing steps a) and b) for each
10 intermediate node receiving an idle signal.
11

1 5) The method of claim 4, further comprising the step
2 of:
3 a) receiving said restoration signal having a
4 node identification number for said originating node
5 over a link other than said failed link connected to
6 said terminating node;
7 b) disconnecting inputs for receiving said
8 information signals from said failed links;
9 c) connecting said inputs for receiving said
10 information signals to said link over which said
11 restoration signal was received by said terminating
12 node; and
13 d) sending an idle signal in all links connected
14 to said terminating node except for said link over which
15 said restoration signal was received by said terminating
16 node.

1 6. The method of claim 5, further comprising the step
2 of:
3 a) receiving said restoration signal having a
4 node identification number for said terminating node
5 over a link other than said failed link connected to
6 said originating node;
7 b) disconnecting inputs for sending said
8 information signals over said failed links;
9 c) connecting said inputs for sending said
10 information signals to said link over which said
11 restoration signal was received by said originating
12 node; and
13 d) sending an idle signal in all links connected
14 to said originating node except for said link over which
15 said restoration signal was received by said originating
16 node.

1 7. The method of claim 6, wherein said step for
2 determining said alternate path is executed until at
3 least one terminating condition is fulfilled from a
4 group comprising: (1) all failed channels are restored;
5 (2) there are no more available restoration channels on
6 any link connected to one of said originating node and
7 terminating node; (3) a predetermined delay period
8 expires and a restoration signal is not received by one
9 of said originating node and terminating node; and (4) a
10 node receives a command from a central controller to
11 halt restoration.

1 8. The method of claim 7, wherein said failed link has
2 multiple information channels, further comprising the
3 steps of:
4 determining an alternate path through the network
5 for information signals from each failed information
6 channel using restoration and idle signals sent over
7 available restoration channels for each link connected
8 to said originating node;
9 routing said information signals from said
10 originating node to said terminating node in accordance
11 with said alternate paths.

1 9. The method of claim 8, further comprising the steps
2 of:
3 repairing said failed link;
4 receiving an idle signal at said originating node
5 and said terminating node over said restoration channels
6 for said repaired link;
7 routing said information signals for said failed
8 information channels from said alternate path of links
9 and at least one intermediate node to said repaired
10 information channels;
11 sending an idle signal over said restoration
12 channels for said alternate path of links and at least
13 one intermediate node.

1 10. A method for restoring communications in a network,
2 the network having a plurality of nodes, with each pair
3 of nodes connected by a link, with each link having
4 information channels and restoration channels,
5 comprising the steps of:
6 sending an idle signal on each restoration channel
7 for each link;
8 detecting a failure of an intermediate node between
9 an originating node and a terminating node, said
10 intermediate node switching information signals carried
11 by at least one information channel for a plurality of
12 links terminating at said intermediate node and carrying
13 information signals from said originating node to said
14 terminating node;
15 determining an alternate path through the network
16 around said failed node using restoration and idle
17 signals sent over restoration channels for links not
18 terminating at said failed node; and
19 routing said information signals from said
20 originating node to said terminating node in accordance
21 with said alternate path.

- 1 11. The method of claim 10, wherein said step for
- 2 determining comprises the steps of:
- 3 identifying information channels for nodes having
- 4 links terminating at said failed node;
- 5 ranking said nodes using a connection map;
- 6 sequentially restoring said information channels
- 7 for nodes having links terminating at said failed node
- 8 according to said rankings until all said information
- 9 channels are restored.